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# The role of smartphone addiction and family dynamics in sleep quality among earthquake-affected adolescents

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## Abstract

**Background** Smartphone addiction is increasingly prevalent, particularly among younger individuals, and has been linked to poor sleep quality. This study aims to assess the effects of smartphone addiction, usage time, socio-demographic factors, relationship with parents, parents' smartphone usage duration, and earthquake-related experiences on sleep quality among adolescents in the earthquake-affected Kahta district of Adıyaman, Turkey.

**Materials and methods** A cross-sectional study was conducted between June 1st and July 31st 2024 with 394 adolescents aged 12 to 18. Data were collected using a questionnaire that included socio-demographic variables, the Pittsburgh Sleep Quality Index (PSQI), and the Smartphone Addiction Scale.

**Results** The prevalence of smartphone addiction was 57.9%, while 66.2% of participants had poor sleep quality. Adolescents using smartphones for more than two hours daily had a higher frequency of poor sleep quality ($p=0.024$). Parental influence was significant: participants whose mothers used smartphones for more than one hour daily had a 2.03 times higher risk of poor sleep quality ($p=0.022$). Adolescents with poor relationships with parents had a significantly higher risk of sleep disturbances ($p<0.001$). Additionally, those who experienced intense fear during the earthquake or lost loved ones showed significantly worse sleep quality ($p=0.007$).

**Conclusion** Smartphone addiction and prolonged usage are strongly associated with poor sleep quality among adolescents. Maternal smartphone use, affects adolescent sleep. Moreover, traumatic experiences related to the earthquake, such as fear and loss, significantly worsen sleep quality. These findings highlight the need for interventions addressing both smartphone addiction and family dynamics to improve sleep health in disaster-affected adolescents.

**Clinical trial number** Not applicable.

**Keywords** Smartphone usage, Sleep quality, Earthquake trauma, Adolescents

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## Introduction

Earthquakes are one of the natural disasters that can lead to devastating effects. On February 6, 2023, earthquakes with magnitudes of 7.7 and 7.6, centered in Kahramanmaraş, have been described as one of the most significant disasters in recent times. These earthquakes affected a vast area, including southeastern Turkey and northern Syria [1]. According to official statements, more than 50,000 people lost their lives in Turkey, and over 115,000 were injured [2]. The province of Adıyaman was among the severely affected areas. Although the destruction and loss of life in Kahta, a district of Adıyaman, were less affected than the central district, this district also experienced the earthquake and received a large influx of migrants from the central province afterward. Adolescents who experience extraordinary events like earthquakes are often more affected than adults. One of the most common issues faced by adolescents after an earthquake is sleep problems [3].

Sleep is one of the most fundamental physiological needs and significantly impacts individuals' quality of life and health [4]. From infancy, sleep plays a critical role in the growth and development of adolescents [5]. Therefore, adequate and quality sleep is essential for a healthy life. School-aged children need 10–11 h of sleep, adolescents require 9–10 h, and adults need 6–8 h [6, 7]. Sleep quality is determined by sleep duration, time taken to fall asleep, the number of nighttime awakenings, and the depth and restfulness of sleep [8]. Sufficient and high-quality sleep has been proven to positively affect physical health, mental health, and cognitive and behavioral functions [9]. Insufficient and poor-quality sleep can lead to daytime sleepiness, inattentive behaviors, accidents, immune system disruptions, and psychosocial issues [10, 11]. Additionally, factors such as age, gender, socioeconomic status, various medical problems (sleep apnea, depression, anxiety, etc.), smoking, alcohol, caffeine, substance use, nutrition, physical activity, and stress, along with the excessive use of technological devices (television, phone, computer, etc.), have been shown to impact sleep quality in recent years [10, 12 Studies indicate that smartphone, internet, and social media addiction negatively affect sleep quality [4, 13, 14, 15, 16].

With advancing technology, the use of smartphones has significantly increased and continues to rise [17]. According to data from the Turkish Statistical Institute (TUIK) in 2021, it was found that the frequency of smartphone use among adolescents in Turkey was 64.4% [18]. While smartphones offer fast and easy communication, easy access to information, efficient time management, and socialization, excessive use can result in smartphone addiction (SBA) [19, 20]. Although there is no official definition of smartphone addiction, it is generally described in the literature as a type of behavioral addiction where the use of smartphones disrupts daily life [16]. Smartphone addiction can lead to numerous physical, social, and psychological problems, one of which is poor sleep quality, as demonstrated in various studies [4, 19, 20, 21].

Family-related factors influencing adolescents' sleep quality is an expected phenomenon that has been explored in numerous previous studies. Research conducted in Italy and the United States has shown that adolescents who maintain more positive relationships with their families have significantly higher sleep quality and longer sleep duration [22–23]. In a study from Canada, adolescents experiencing more stressful relationships with their parents were found to have shorter sleep duration [24]. Another study during the COVID-19 pandemic demonstrated a correlation between familial support and adolescents' sleep quality and duration [25]. Given that adolescence is a period in which individuals prepare for adulthood yet remain dependent on their families, it is unsurprising that family relationships impact sleep quality.

The technological era in which we live affects our lives. Additionally, experiencing extraordinary events such as earthquakes can alter individuals' lives and habits. Numerous studies have demonstrated that mental health disorders, including post-traumatic stress disorder (PTSD), depression, and anxiety disorders, are more prevalent among adolescents residing in disaster-affected areas [26, 27, 28]. This increased prevalence has been associated with factors such as the loss of loved ones or family members, the fear experienced during the disaster, the displacement caused by damage to residences, and the subsequent changes in living environments, schools, and social networks. Adolescence is a critical period when the foundations of an individual's future physical, mental, and social well-being are laid, and habits formed during childhood and adolescence can influence the rest of life [29]. Intervening in these habits during this period can contribute to a more effective, productive, and healthy adulthood. From this perspective, this study aimed to examine how adolescents' smartphone use, earthquake-related experiences, sociodemographic characteristics, family relationships, and the duration of smartphone use within the family relate to adolescents' sleep quality. Rather than examining how these variables interact, this study focused on how each affected adolescents' sleep quality. The present study holds particular value as it explores an under-researched aspect of mental health problems in earthquake-affected region, contributing to the limited body of literature in this field.

## Materials and methods

### Study design and participants

This cross-sectional study was conducted in schools in the Kahta district of Adıyaman, located in the

Southeastern Anatolia region of Turkey, between June 15th and July 31st, 2024. The study population consisted of school-aged adolescents aged 12 to 18 who experienced the earthquake in Kahta, Adıyaman. For the sample, three schools were selected from middle and high schools in three different regions of the Kahta district. Adıyaman is a province located in the Southeastern Anatolia region of Turkey, with a population of around 600,000. Kahta, with a population of about 100,000, is the largest district in the province and serves as a center for nearby smaller districts. For this study, one middle school and one high school were selected from the district's northern, southern, and eastern parts. Because the district's western part is still under development, no school was chosen from that area. The aim was to create a sample that represents the district as a whole. The total number of students at the selected middle schools ranged from 600 to 700, with 20 to 24 classes. The total number of students in the high schools was between 800 and 900, with 30 to 35 classes. In Turkey, middle school lasts four years; however, because the first two grades fell outside the target age range, only 7th and 8th graders were invited to participate. Six classes were randomly selected from the middle schools, yielding 145 students, of whom 129 agreed to participate. High school also spans four years in Turkey. Twelve classes were randomly selected from the high schools, reaching 308 students, and 278 agreed to participate. Twelve individuals were excluded from the study because they had not experienced the earthquake, and one person was excluded due to an epilepsy diagnosis. Random classes were chosen from the selected schools. After providing the necessary information, the questionnaire and consent forms were distributed to the students so they could obtain consent from their families. Face-to-face administration of the questionnaires was conducted with participants whose families—and the students—agreed to participate. The researchers were responsible for informing the participants and overseeing the completion of the questionnaires. Because of the study's cross-sectional design, a sample size reflecting the entire population was not calculated. However, the minimum sample size for the study was calculated as 334 using the G*Power 3.1.9.7 software with a Type I error (α error) of 0.05, an effect size of 0.5, and a power (1-β error) of 99%.[4] To account for potential data loss, the target was increased by 10%, aiming to reach at least 367 participants. Participants who had a smartphone with an active internet connection and whose parents provided verbal and written consent for their participation were included in the study after obtaining verbal consent from the participants. Individuals who were not present in Adıyaman during the earthquake, those diagnosed and receiving treatment for neurological disorders such as epilepsy that could disrupt sleep, and non-Turkish citizens were excluded from the study.

#### Data collection tools and process

The participants completed a questionnaire developed based on a literature review. The questionnaire comprised 54 questions divided into three sections. The first section included questions about socio-demographic and earthquake-related characteristics (age, gender, school performance, daily exercise, place of residence, relationship with parents, parental education, parental employment, family income, marital status of parents, number of siblings, total number of smart devices in the household, daily smart device usage time of the individual, mother, and father, location during the earthquake, presence of a family member trapped under the rubble, loss of a relative in the earthquake, post-earthquake relocation, current place of residence, and level of fear experienced during the earthquake). The number of smart devices in the household was presented as a multiple-choice question with five options: 0, 1, 2, 3, and 4 or more. The question regarding the relationship with parents was also presented as a multiple-choice question with the options: very good, good, average, poor, and very poor. The fear experienced during an earthquake was assessed with three options: not afraid, afraid, and very afraid. Daily smart device usage was presented with five options: less than 1 h, 1–2 h, 3–4 h, 5–6 h, and more than 6 h. This section consists of questions created explicitly by the researchers for this study. The answers were presented in a multiple-choice format to simplify statistical evaluation, and participants were asked to select the responses that best suited to them. The second section included the Pittsburgh Sleep Quality Index, and the third included the Smartphone Addiction Scale. Data were collected through face-to-face interviews with students from middle and high schools in Kahta who agreed to participate.

*The Pittsburgh Sleep Quality Index (PSQI)* was developed by Buysse et al. in 1989 to assess individuals' sleep quality over the past month [8]. The scale consists of 24 questions, 19 of which are self-reported. The remaining five questions are answered by a spouse or roommate, if applicable, but are not included in the scoring. Seven components are derived from questions scored between 0 and 3: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The scores from each component are summed to obtain a total score ranging from 0 to 21, with higher scores indicating poorer sleep quality. A score greater than 5 indicates poor sleep quality. The Turkish validity and reliability of this scale were established by Ağargün et al. in 1996 [10]. The scale has not been specifically adapted for adolescents; however, because most studies in the literature

have employed the Pittsburgh Sleep Quality Index, this scale was selected. In the study by Buysse et al., Cronbach's alpha was 0.83, while in the study by Ağargün et al., it was 0.80 [8, 10]. In this study, Cronbach's alpha was calculated as 0.69.

*The Smartphone Addiction Scale* was developed by Kwon et al. in 2013. The original scale consists of 33 items, and a short version with 10 questions on a 6-point Likert scale (1: strongly disagree, 6: strongly agree) was created for use with adolescents [19, 30]. The Turkish adaptation of the short version was carried out by Şata and colleagues in 2017, and the short version was also used in this study [24]. The total score ranges from 10 to 60, with a score above 29.5 indicating smartphone addiction. In the original scale, Cronbach's alpha was 0.91; in the Turkish adaptation, it was 0.90 [30, 31]. In this study, Cronbach's alpha was calculated as 0.88.

### Ethical approval

Ethics committee approval was obtained from the Non-Interventional Research Ethics Committee of Fırat University, with a decision dated 06.06.2024 and numbered 2024/9–30. Before starting the study, ethical approval and official permission were obtained from the relevant schools in Kahta. Written and verbal consent was obtained from all participants' parents, and the study followed the principles outlined in the Declaration of Helsinki.

#### *Clinical trial number: not applicable*

### Statistical analysis

Statistical analyses were performed using SPSS (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL) version 25. Descriptive data were presented as n (%) for categorical variables and mean ± standard deviation (mean ± sd) for continuous variables. The normality of the distribution of continuous variables was assessed using the Kolmogorov-Smirnov/Shapiro-Wilk test and visual methods (histograms and probability plots). For continuous variables that did not follow a normal distribution, the Mann-Whitney U test was used for comparisons between two independent groups, and the Kruskal-Wallis test was used for comparisons among more than two groups. Chi-square analysis was applied to compare categorical variables. Bonferroni-adjusted post-hoc analyses were conducted for significant comparisons among more than two groups. The relationship between non-normally distributed continuous variables was assessed using the Spearman correlation test. In evaluating the factors affecting poor sleep quality, variables with a p-value less than 0.1 in the univariate analyses were included in the multivariate logistic regression analysis. Before including the variables in the model, it was checked whether there was a multicollinearity problem by examining whether their correlation coefficient exceeded 0.6. Model fit was assessed using the Hosmer-Lemeshow test, and the results of the analysis were presented as odds ratios (OR) and confidence intervals (CI). A p-value of $< 0.05$ ($p < 0.017$ in Bonferroni-adjusted post-hoc tests) was considered statistically significant.

Effect sizes were also assessed to gauge the strength of the associations. For Spearman's rho, Cohen's (1988) guidelines were followed, with coefficients of approximately 0.10, 0.30, and 0.50 representing small, medium, and large effects, respectively. For odds ratios, the recommendations of Chen, Cohen, and Chen (2010) were used, where ORs of about 1.5, 2.5, and 4.0 indicate small, medium, and large effects, respectively [32, 33].

## Results

394 adolescents participated in the study, with 196 males (49.7%) and 198 females (50.3%). The average age of the participants was 15.8 ± 1.5 years (min: 12, max: 18). Among the participants, 250 (63.5%) reported having four or more smart devices in their homes, and 279 (70.8%) indicated using smart devices for three hours or more per day. Additionally, 96.7% of the participants were inside a building during the earthquake, and 80.2% had either themselves or a family member trapped under the rubble. Furthermore, 40.1% of the participants lost a relative in the earthquake, and 10.4% lived in a container home. The frequency of smartphone addiction among participants was 57.9%, while the frequency of poor sleep quality was 66.2%. Other descriptive characteristics of the participants are presented in Table 1.

In this study, the dependent variable was the sleep quality score, while the independent variables included smartphone addiction, sociodemographic characteristics, questions indicating the extent of earthquake impact, family characteristics, and smartphone use within the family.

Among the participants, those with poor sleep quality had a higher mean age than those with normal sleep quality (z = -2.62, $p < 0.009$). Participants with poor school performance had higher sleep quality scores (indicating worse sleep quality) than those with good school performance ($\chi^2(1) = 12{,}28(2)$, $p = 0.002$). The sleep quality score (z=-4,84, $p < 0.001$) and the frequency of poor sleep quality ($\chi^2(1) = 20{,}32(1)$, $p < 0.001$) were significantly higher among those with poor or average parental relationship status compared to those with good relationships. Participants whose parents were married had significantly lower sleep quality scores ((z=-3,69, $p < 0.001$) and a lower frequency of poor sleep quality ($\chi^2(1) = 8{,}99(1)$, $p = 0.003$) compared to those whose parents were separated. Participants whose mothers used smart devices for less than one hour daily had a lower frequency of poor sleep

**Table 1** Descriptive characteristics of participants ($n = 394$)

| Variables | | *n* (%) / Mean ± SD |
|---|---|---|
| Gender | Male | 196 (49.7) |
| | Female | 198 (50.3) |
| Age | | 15.8 ± 1.5 |
| School performance | Good | 216 (54.8) |
| | Average | 125 (31.7) |
| | Poor | 53 (13.5) |
| Daily exercise (in the past month) | None | 162 (41.1) |
| | Less than one hour | 115 (29.2) |
| | More than one hour | 117 (29.7) |
| Place of residence | City center | 60 (15.2) |
| | District center | 275 (69.8) |
| | Rural areas | 59 (15) |
| Relationship with parents | Good | 210 (53.3) |
| | Average | 132 (33.5) |
| | Poor | 52 (13.2) |
| Mother's education level | Middle school or below | 244 (61.9) |
| | High school or above | 150 (38.1) |
| Father's education level | Middle school or below | 149 (37.8) |
| | High school or above | 245 (62.2) |
| Mother's employment status | Unemployed | 269 (68.3) |
| | Employed | 125 (31.7) |
| Father's employment status | Unemployed | 57 (14.5) |
| | Employed | 337 (85.5) |
| Family income | Less than expenses | 110 (27.9) |
| | Equal to expanses | 169 (42.9) |
| | More than expanses | 115 (29.2) |
| Parental marital status | Married | 346 (87.8) |
| | Separated | 48 (12.2) |
| Number of siblings | 0–1 | 39 (9.9) |
| | 2–3 | 172 (43.7) |
| | 4 and above | 183 (46.4) |
| Total number of smart devices in the home | 0–1 | 10 (2.5) |
| | 2–3 | 134 (34.0) |
| | 4 and above | 250 (63.5) |
| Mother's daily smart device usage | Less than one hour | 115 (29.2) |
| | 1–2 h | 141 (35.8) |
| | 3 h and more | 138 (35) |
| Father's daily smart device usage | Less than one hour | 76 (19.3) |
| | 1–2 h | 132 (33.5) |
| | 3 h and more | 186 (47.2) |
| Adolescent's daily smart device usage | Less than one hour | 46 (11.7) |
| | 1–2 h | 69 (17.5) |
| | 3 h and more | 279 (70.8) |
| Location during the earthquake | Inside a building | 381 (96.7) |
| | Outside a building | 13 (3.3) |
| Him/herself or family member trapped under rubble | Yes | 78 (19.8) |
| | No | 316 (80.2) |
| Loss of a relative due to the earthquake | Yes | 158 (40.1) |
| | No | 236 (59.9) |
| Post-earthquake relocation | Yes | 121 (30.7) |
| | No | 273 (69.3) |

**Table 1** (continued)

| Variables | | *n* (%) / Mean ± SD |
|---|---|---|
| Current residence | Own home | 241 (61.2) |
| | Rented/Relative's home | 112 (28.4) |
| | Container | 41 (10.4) |
| Level of fear during the earthquake | Not afraid | 23 (5.8) |
| | Afraid | 115 (29.2) |
| | Very afraid | 256 (65) |
| Smartphone addiction score / Addiction status | | 32.5 ± 11.9 / 228 (57.9) |
| Sleep quality score / Poor sleep quality | | 7.1 ± 3.5 / 261 (66.2) |

quality than those who used them for one hour or more ($\chi^2(1) = 5{,}69(1)$, $p = 0.017$). The participant's daily smart device usage of more than three hours was associated with a lower frequency of poor sleep quality compared others ($\chi^2(2) = 7.49(2)$, $p = 0.024$). The frequency of poor sleep quality was higher among participants who had a family member trapped under the rubble ($\chi^2(1) = 6{,}22(1)$, $p = 0.013$) and those who lost a relative in the earthquake ($\chi^2(1) = 7{,}19(1)$, $p = 0.007$). Participants who were not afraid at the time of the earthquake had a higher frequency of poor sleep quality than those who were very afraid ($\chi^2(1) = 10{,}03(2)$, $p = 0.007$) (Table 2).

Among those identified as not addicted, 43.4% (72 individuals) reported normal sleep quality while 56.6% (94 individuals) experienced poor sleep quality—a difference that was statistically significant ($\chi^2(1) = 11.865$, $p = 0.001$). In contrast, within the addicted group, only 26.8% (61 individuals) had normal sleep quality compared to 73.2% (167 individuals) with poor sleep quality. Moreover, the median smartphone addiction score was significantly higher in participants with poor sleep quality [34.0 (range: 10.0–60.0)] than in those with normal sleep quality [29.0 (range: 10.0–57.0)], as indicated by the Mann–Whitney U test (z = -4.411, $p < 0.001$).

Among participants, Spearman correlations were calculated to examine the relationships between various dimensions of sleep quality and both age and smartphone addiction scores. The total sleep quality score was significantly positively correlated with age (rho(394) = 0.142, $p = 0.005$, mild effect) and with smartphone addiction (rho(394) = 0.250, $p < 0.001$, mild effect). Similarly, subjective sleep quality showed significant correlations with age (rho(394) = 0.120, $p = 0.017$, mild effect) and with smartphone addiction (rho(394) = 0.251, $p < 0.001$, mild effect). While sleep latency was not significantly correlated with age (rho(394) = 0.027, $p = 0.590$), it was significantly correlated with smartphone addiction (rho(394) = 0.128, $p = 0.011$, mild effect). Sleep duration did not have significant correlations with either age (rho(394) = 0.074, $p = 0.142$) or smartphone addiction (rho(394) = 0.040, $p = 0.433$), and habitual sleep efficiency was also not significantly associated with age (rho(394) = 0.032, $p = 0.528$) or smartphone addiction (rho(394) = 0.065, $p = 0.195$). In contrast, sleep disturbances were significantly correlated with both age (rho(394) = 0.129, $p = 0.010$, mild effect) and smartphone addiction (rho(394) = 0.236, $p < 0.001$, mild effect). The use of sleep medication exhibited significant correlations with age (rho(394) = 0.113, $p = 0.024$, mild effect) and with smartphone addiction (rho(394) = 0.174, $p = 0.001$, mild effect), and finally, daytime dysfunction was significantly correlated with age (rho(394) = 0.145, $p = 0.004$, mild effect) as well as with smartphone addiction (rho(394) = 0.212, $p < 0.001$, mild effect).

Variables with a p-value below 0.1 in the univariate analyses were included in the multivariate logistic regression model. Since the correlation coefficients among the variables were below 0.6, no multicollinearity problem was detected. According to the multivariate logistic regression analysis, the likelihood of having poor sleep quality increased by 1.20 times (95% CI: 1.02–1.41) for each one-year increase in age and by 1.04 times (95% CI: 1.01–1.06) for each one-unit increase in smartphone addiction score. Additionally, having an average or poor parental relationship status increased the risk of poor sleep quality by 2.23 times (95% CI: 1.32–3.74) (Table 3).

## Discussion

Smartphone addiction is a growing phenomenon in the developing world and is being observed in younger individuals over time. Numerous studies have sought to explore the relationship between sleep quality and smartphone addiction. Many studies have found that as smartphone usage increases, sleep quality decreases [4, 14, 16, 34, 35]. Similarly, in our study, those with smartphone addiction and higher smartphone usage reported poorer sleep quality. However, the prevalence of smartphone addiction varies. A study conducted with university students in 2024 found the prevalence of smartphone addiction to be 27.5%, while a study conducted with middle school students in Korea reported this rate as 4.7% [34, 36]. In another study conducted in China in 2024 among medical students, this rate was found to be 47.5% [37]. In the present study, the prevalence of smartphone addiction was higher at 57.9%. Another reason for the difference in smartphone usage frequency is that while Güçlü et al. and Zhang et al. used the original scale's cutoff

**Table 2** Comparison of sleep quality status and scores according to various characteristics of participants ($n=394$)

| | | Sleep Quality | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Sleep Quality Scores Median (min-max)** | **z / χ2(1)** | ***p*** | **Normal (*n* = 133) *n* (%)** | **Poor (*n* = 261) *n* (%)** | **z / χ2(1)** | ***p*** |
| Age | | - | - | - | 15.5 ± 1.7 | 16.0 ± 1.4 | -2.62 | ***0.009**** |
| Gender | Male | 7.0 (0.0–15.0) | -1.31 | 0.210* | 68 (34.7) | 128 (65.3) | 0.15 (1) | 0.695† |
| | Female | 8.0 (0.0–18.0) | | | 65 (32.8) | 133 (67.2) | | |
| School Performance | Good | 7.0 (0.0–18.0)[a] | 12.28 (2) | ***0.002**** | 83 (38.4) | 133 (61.6) | 5.66 (1) | 0.059† |
| | Average | 7.0 (0.0–18.0) | | | 38 (30.4) | 87 (69.6) | | |
| | Poor | 9.0 (2.0–14.0)[b] | | | 12 (22.6) | 41 (77.4) | | |
| Daily Exercise (last month) | None | 8.0 (0.0–18.0) | 3.33(2) | 0.190** | 50 (30.9) | 112 (69.1) | 1.13 (2) | 0.568† |
| | Less than one hour | 7.0 (1.0–16.0) | | | 40 (34.8) | 75 (65.2) | | |
| | One hour and more | 6.0 (0.0–15.0) | | | 43 (36.8) | 74 (63.2) | | |
| Place of Residence | City center | 8.0 (0.0–18.0) | 3.36 (2) | 0.187** | 18 (30) | 42 (70) | 1.70 (2) | 0.428† |
| | District center | 7.0 (0.0–18.0) | | | 91 (33.1) | 184 (66.9) | | |
| | Rural areas | 7.0 (0.0–16.0) | | | 24 (40.7) | 35 (59.3) | | |
| Relationship with Parents | Good | 6.0 (0.0–16.0) | -4.84 | ***< 0.001**** | 92 (43.8) | 118 (56.2) | 20.32(1) | ***< 0.001**** |
| | Average-Poor | 8.0 (0.0–18.0) | | | 41 (22.3) | 143 (77.7) | | |
| Mother's Education Level | Middle school and below | 7.0 (0.0–15.0) | -0.47 | 0.638* | 81 (33.2) | 163 (66.8) | 0.09 (1) | 0.764† |
| | High school and above | 7.0 (0.0–18.0) | | | 52 (34.7) | 98 (65.3) | | |
| Father's Education Level | Middle school and below | 7.0 (0.0–16.0) | -0.69 | 0.491* | 55 (36.9) | 94 (63.1) | 1.07 (1) | 0.301† |
| | High school and above | 7.0 (0.0–18.0) | | | 78 (31.8) | 167 (68.2) | | |
| Mother's Employment Status | Unemployed | 7.0 (0.0–18.0) | -0.53 | 0.593* | 88 (32.7) | 181 (67.3) | 0.41 (1) | 0.521† |
| | Employed | 7.0 (0.0–18.0) | | | 45 (36) | 80 (64) | | |
| Father's Employment Status | Unemployed | 8.0 (0.0–13.0) | -1.84 | 0.066* | 14 (24.6) | 43 (75.4) | 2.52 (1) | 0.112† |
| | Employed | 7.0 (0.0–18.0) | | | 119 (35.3) | 218 (64.7) | | |
| Family Income | Less than expanses | 8.0 (0.0–16.0) | 0.73 (2) | 0.693** | 37 (33.6) | 73 (66.4) | 0.64 (2) | 0.726† |
| | Equal to expanses | 7.0 (1.0–18.0) | | | 54 (32) | 115 (68) | | |
| | More than expanses | 7.0 (0.0–18.0) | | | 42 (36.5) | 73 (63.5) | | |
| Parental Marital Status | Married | 7.0 (0.0–18.0) | -3.69 | ***< 0.001**** | 126 (36.4) | 220 (63.6) | 8.99 (1) | ***0.003**** |
| | Separated | 9.0 (2.0–18.0) | | | 7 (14.6) | 41 (85.4) | | |
| Number of Siblings | 0–1 | 8.0 (0.0–15.0) | 1.76 (2) | 0.415** | 13 (33.3) | 26 (66.7) | 0.76 (2) | 0.686† |
| | 2–3 | 7.0 (0.0–18.0) | | | 62 (36) | 110 (64) | | |
| | 4 and more | 7.0 (0.0–18.0) | | | 58 (31.7) | 125 (68.3) | | |
| Total Number of Smart Devices at Home | 0–1 | 9.0 (2.0–13.0) | 1.80 (2) | 0.407** | 2 (20) | 8 (80) | 1.14 (2) | 0.567† |
| | 2–3 | 7.0 (0.0–16.0) | | | 48 (35.8) | 86 (64.2) | | |
| | 4 and more | 7.0 (0.0–18.0) | | | 83 (33.2) | 167 (66.8) | | |
| Mother's Daily Smart Device Usage | Less than one hour | 6.0 (0.0–18.0) | 2.81 (2) | 0.245** | 49(42.6) | 66(57.4) | 6.08 (2) | ***0.048**** |
| | 1–2 h | 8.0 (0.0–14.0) | | | 40(28.4) | 101(71.6) | | |
| | 3 h or more | 7.0 (0.0–18.0) | | | 44(31.9) | 94(68.1) | | |
| Father's Daily Smart Device Usage | Less than one hour | 7.0 (0.0–18.0) | 2.69 (2) | 0.261** | 31(40.8) | 45(59.2) | 5.48 (2) | 0,065† |
| | 1–2 h | 7.0 (0.0–18.0) | | | 50(37.9) | 82(62.1) | | |
| | 3 h or more | 7.0 (0.0–18.0) | | | 52(28.0) | 134(72.0) | | |
| Adolescent's Daily Smart Device Usage | Less than one hour | 8.0 (0.0–15.0) | 9.94 (2) | ***0.007**** | 15(32.6) | 31(67.4) | 7.49 (2) | ***0.024**** |
| | 1–2 h | 6.0 (0.0–13.0)[a] | | | 33(47.8) | 36(52.2)[a] | | |
| | 3 h or more | 7.0 (0.0–18.0)[b] | | | 85(30.5) | 194(69.5)[b] | | |
| Location During Earthquake | Inside a building | 7.0 (0.0–18.0) | -0.37 | 0.712* | 129 (33.9) | 252 (66.1) | 0.05 (1) | 0.817† |
| | Outside a building | 7.0 (2.0–10.0) | | | 4 (30.8) | 9 (69.2) | | |
| Him/herself or family member trapped under rubble | Yes | 8.0 (0.0–16.0) | -3.68 | ***< 0.001**** | 17 (21.8) | 61 (78.2) | 6.22 (1) | ***0.013**** |
| | No | 7.0 (0.0–18.0) | | | 116 (36.7) | 200 (63.3) | | |
| Loss of a relative due to the earthquake | Yes | 8.0 (0.0–18.0) | -4.93 | ***< 0.001**** | 41 (25.9) | 117 (74.1) | 7.19 (1) | ***0.007**** |
| | No | 6.0 (0.0–16.0) | | | 92 (39.0) | 144 (61.0) | | |

**Table 2** (continued)

| | | Sleep Quality | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Sleep Quality Scores Median (min-max)** | **z / χ2(1)** | ***p*** | **Normal (*n* = 133) *n* (%)** | **Poor (*n* = 261) *n* (%)** | **z / χ2(1)** | ***p*** |
| Post-earthquake relocation | Yes | 8.0 (1.0–18.0) | -3.85 | ***< 0.001**** | 33 (27.2) | 88 (72.7) | 3.28 (1) | 0.070† |
| | No | 7.0 (0.0–18.0) | | | 100 (36.6) | 173 (63.4) | | |
| Current residence | Home | 7.0 (0.0–18.0) | -2.40 | ***0.016**** | 123 (34.8) | 230 (65.2) | 1.80 (1) | 0.180† |
| | Container | 8.0 (3.0–18.0) | | | 10 (24.4) | 31 (75.6) | | |
| Level of fear during the earthquake | Not afraid | 5.0 (0.0–12.0)[a] | 25.44 (2) | ***< 0.001***** | 13 (56.5) | 10 (43.5)[a] | 10.03(2) | ***0.007***† |
| | Afraid | 6.0 (0.0–14.0)[a] | | | 46 (40.0) | 69 (60.0) | | |
| | Very afraid | 8.0 (0.0–18.0)[b] | | | 74 (28.9) | 182 (71.1)[b] | | |

*Mann Whitney u test, **Kruskal Wallis test, †Chi-square test, b > a

**Table 3** Logistic regression analysis for factors affecting poor sleep quality

| | **OR** | **%95 CI** | ***p*** |
|---|---|---|---|
| Age | 1.205 | 1.027–1.414 | ***0.022*** |
| Gender (Ref: Male) | | | |
| Female | 1.165 | 0.710–1.913 | 0.546 |
| School performance (Ref: Good) | | | |
| Average | 1.051 | 0.610–1.810 | 0.858 |
| Poor | 0.747 | 0.318–1.756 | 0.504 |
| Relationship with parents (Ref: Good) | | | |
| Average-Poor | 2.230 | 1.327–3.746 | ***0.002*** |
| Parental marital status (Ref: Married) | | | |
| Seperated | 2.405 | 0.980–5.899 | 0.055 |
| Mother's daily smart device usage (Ref: Less than 1 h) | | | |
| 1–2 h | 2.039 | 1.109–3.751 | ***0.022*** |
| 3 h and more | 1.276 | 0.664–2.455 | 0.464 |
| Father's daily smart device usage (Ref: Less than 1 h) | | | |
| 1–2 h | 1.047 | 0.521–2.108 | 0.897 |
| 3 h and more | 1.269 | 0.617–2.613 | 0.517 |
| Adolescent's daily smart device usage (Ref: Less than 1 h) | | | |
| 1–2 h | 0.409 | 0.164–1.021 | 0.056 |
| 3 h and more | 0.531 | 0.228–1.238 | 0.143 |
| Trapped under rubble (self/family member) (Ref: No) | | | |
| Yes | 1.591 | 0.811–3.123 | 0.177 |
| Loss of a relative in the earthquake (Ref: No) | | | |
| Yes | 1.253 | 0.719–2.185 | 0.426 |
| Post-earthquake relocation (Ref: No) | | | |
| Yes | 0.967 | 0.543–1.721 | 0.909 |
| Level of fear during the earthquake (Ref: Not afraid) | | | |
| Afraid | 1.655 | 0.582–4.710 | 0.345 |
| Very afraid | 2.753 | 0.992–7.639 | 0.052 |
| Smartphone addiction score | 1.041 | 1.016–1.066 | ***0.001*** |

-2 Log likelihood: 431.779; Nagelkerke $R^2$: 0.232; Hosmer-lemeshow test p: 0.151

values of 31 for men and 33 for women, our study applied the cutoff value of 29.5 from the adapted scale. In addition, the study conducted in Korea used a different scale. It was also inferred that the high prevalence might be attributable to the region's already limited variety and accessibility of social facilities, which became even more restricted following the earthquake. In summary, the prevalence of smartphone addiction may vary depending on the country or local factors in the regions where the study is conducted.

Sleep quality issues are common among adolescents. The prevalence varies by country and age group. In studies conducted in Turkey in 2022 and 2024, the prevalence of poor sleep quality was 58.7% and 53%, respectively [4, 34]. In studies conducted in South Korea in 2022, the rates were 70.9% and 69% [30, 31]. In Brazil, a 2020 study

found the rate to be 51.7%, while a 2023 study in Tunisia reported 94%. Other studies found rates of 31% in Nepal (2021), 55.3% in Greece (2018), and 29.1% in China (2018) [38, 39, 40, 41, 42, 43]. In our study, 66.2% of participants had poor sleep quality. The prevalence varies across studies, but in the best-case scenario, one in three adolescents experiences sleep disturbances, necessitating further exploration of risk factors for sleep disorders.

While sleep disorders are expected to be more common in earthquake zones, few studies exist. A 2018 study conducted in China with 6,182 adolescents found prevalence of poor sleep quality 29.1%. [44]. While factors like smartphone, screen, and internet addiction continue to disrupt sleep quality in modern life, the earthquake may shift this distribution. Indeed, studies from earthquake zones, such as one from China in 2018, showed that as the fear experienced during the earthquake increased, so did the frequency of sleep problems. Those injured or who lost loved ones or witnessed death and injury during the earthquake were more likely to experience sleep problems [44]. A 2013 study from Japan found that children whose homes were damaged, who were displaced, or who lost loved ones experienced more frequent sleep problems [45]. Similarly, in our study, individuals most affected by the earthquake—those who lost loved ones, lived in containers, felt intense fear during the earthquake, or had to relocate—had poorer sleep quality. Given the trauma caused by the earthquake, this is an expected outcome. However, further research and advanced studies are needed to guide interventions for improving sleep quality for a sensitive group like adolescents still undergoing physical and psychological development.

When examining the causes of sleep disorders, it is essential to consider the frequency of smartphone usage by parents and adolescents. A 2022 study conducted in China with 4,287 students found that sleep quality declined when smartphone usage exceeded two hours [46]. In our study, smartphone usage of more than two hours was also identified as a risk factor for poor sleep quality. The direct impact of parents' smartphone use on adolescents, particularly a greater sensitivity to maternal smartphone usage, may be linked to the fact that in Turkish society, mothers typically take on more responsibility for childcare. In the present study, most participating adolescents' mothers were not employed (68.3%), whereas a significant portion of the fathers were working (85.5%). Consequently, adolescents spent more time at home with their mothers than their fathers, which may explain their heightened sensitivity to their mothers' smartphone use. However, larger-scale studies are needed to to explore this issue further.

When examining familial factors affecting sleep disturbances, a 2022 study from the United States involving 517 adolescents found that those with positive relationships with their parents slept 26 min longer. Similarly, a 2018 study in South Korea revealed that adolescents receiving greater family support used smartphones less frequently and consequently experienced fewer sleep problems [47, 48]. A 2022 study in China also found that individuals with poor relationships with their families used smartphones more often and had poorer sleep quality [46]. Studies from Italy and the United States indicate that adolescents with more supportive family relationships exhibit higher sleep quality and longer sleep duration [22, 23]. Findings from a Canadian study suggest that adolescents experiencing greater parental conflict sleep for shorter durations [24]. In the present study, the factors most strongly affecting sleep quality were parents living apart and poor relationships with parents. This underscores the importance of family stability in adolescent development and highlights how much adolescents are influenced by their first role models in life. Families should resolve conflicts without involving their children and should not delay seeking family psychotherapy if necessary.

Studies generally show that as adolescents age, the frequency of poor sleep quality increases [25, 46, 49]. However, some studies found no change in sleep quality with age [14, 32]. In our study, sleep quality declined with age. As adolescents approach adulthood, expectations are replaced by realities. Further studies are needed to provide more recommendations on how to help adolescents transition smoothly into independent adult life.

Generally, females are more likely to experience poor sleep quality, although some studies found no difference between genders [4, 14, 34, 37, 39, 40, 46, 50, 51]. Our study observed no significant difference in sleep quality between genders.

### Limitations

Due to the study's cross-sectional design, causality assessment is limited. Since the survey was conducted in a district and the sample size is relatively small, the findings cannot be generalized to the province or country. The absence of a specific scale in assessing earthquake fear and relying solely on a question-and-answer approach can be considered another limitation of the study. Additionally, recall bias may have occurred as the data were self-reported by participants. Although it is a widely used scale in the literature, the Pittsburgh Sleep Quality Index and its Turkish adaptation used in this study were not explicitly developed for adolescents. The low Cronbach's alpha value in the application of the sleep quality scale, which falls below both the original scale and its Turkish adaptation but is still considered acceptable, can be regarded as one of the study's limitations.

## Conclusion

Numerous studies have demonstrated that mental health disorders, including post-traumatic stress disorder (PTSD), depression, and anxiety disorders, are more prevalent among adolescents residing in disaster-affected areas. The relationship between smartphone addiction and sleep quality has been widely studied in the literature, though studies on adolescents are more limited. Our study is one of the first to examine this relationship among adolescents in earthquake-affected regions. It was determined that adolescents affected by the earthquake experienced more frequent sleep disturbances. Maternal smartphone usage, was a significant factor in adolescent sleep disturbances. Finally, individuals with healthier relationships with their parents had better sleep quality. As smartphones and other similar devices continue to increase, future research on this topic should expand and diversify. Studies targeting families with children should not overlook the fact that appropriate technology use behaviors in parents can serve as inspiration for adolescents.

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**Data availability**
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Ethics approvaland participant consent**
Ethics committee approval was obtained from the Non-Interventional Research Ethics Committee of Fırat University, with a decision dated 06.06.2024 and numbered 2024/9–30. Before starting the study, ethical approval and official permission were obtained from the relevant schools in Kahta. Informed written and verbal consent was obtained from all participants' parents, and the study followed the principles outlined in the Declaration of Helsinki.

**Consent for publication**
Not applicable.

**Competing interests**
The authors declare no competing interests.

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